

## **Claims**

What is claimed is:

1. A system to coordinate at least one of communications, collaboration, and coordination between parties, comprising:
  - a user state identifier that determines a user's state from at least one context information source, wherein the user state identifier generates an indication of whether a user state change has occurred from the at least one context information source; and
  - a data log that stores information associated with the at least one context information source at about the time of the user state change to accumulate statistics relating to at least one of an availability and an unavailability of the user.
2. The system of claim 1, further comprising a forecaster constructed from the accumulated statistics to enable a determination of the user's at least one of availability and unavailability.
3. The system of claim 2, wherein the forecaster employs a probability distribution over a time until the user returns to drive an application wherein the user can review information that has arrived.
4. The system of claim 3, further comprising a notification system to reason about an expected cost of delayed review of information so as to guide decisions about alerting the user before the user can observe the information.
5. The system of claim 4, wherein the notification system utilizes the forecaster to determine the time the user will have access to a communications modality.

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6. The system of claim 4, further comprising a display that is accessed by other users, systems, and applications regarding the at least one of the user's availability and unavailability.
7. The system of claim 4, wherein the forecaster conditions probabilities on different types of appointments that are observed on a calendar.
8. The system of claim 7, wherein the calendar includes such information as a location of meetings.
9. The system of claim 7, wherein the calendar includes such information as a meeting type that is employed to infer whether a user would attend a meeting.
10. The system of claim 7, wherein the notification system shares information based on such considerations as to at least one of the nature and privileges of the person inspecting the calendar.
11. The system of claim 10, wherein the information is based on an inferred urgency of a communication.
12. The system of claim 2, wherein the forecaster is constructed to determine probabilities associated with the users return in an "x" amount of time, given that the user has been away for a "y" amount of time, based upon observed evidence of the user's context.
13. The system of claim 2, wherein the evidence includes at least one of a time period, a calendar state, and location.
14. The system of claim 2, wherein the forecaster utilizes statistical models based upon at least one of a survival curve and a hazard function.

15. The system of claim 2, wherein the forecaster is employed to generate prediction information regarding at least one of the user's likely return and the user's current availability.

16. The system of claim 15, wherein the prediction information includes probabilities associated with the user's likely return and current availability.

17. The system of claim 15, further comprising an e-mail service to generate automated responses to one or more messages based upon the user's availability.

18. The system of claim 17, wherein the automated response includes one or more statements having updated probabilities associated with the user's availability.

19. The system of claim 17, wherein the automated response is at least one of relayed as an average expected time, computed as a sum of times, and weighted by different likelihoods of expected time.

20. The system of claim 15, further comprising a priorities service wherein automated responses are generated as a result of an urgency threshold and the prediction information.

21. The system of claim 20, wherein the priorities service further comprises a user configuration interface to enable at least one of sending an automated response, configuring an urgency threshold, and configuring the amount of time the user is unavailable.

22. The system of claim 20, wherein the priorities service utilizes the prediction information to guide messages to at least one of a device and a location.

23. The system of claim 15, further comprising a voice mail service wherein automated acoustical responses are generated with associated prediction information.

24. The system of claim 23, wherein automated responses are generated that attempt to reschedule a call based upon considerations of the user's availability.

25. The system of claim 15, further comprising a scheduling system, wherein one or more user calendars are automatically updated to reflect the associated user's availability.

26. The system of claim 25, wherein the calendars are updated to include an indication that information within the calendar has been generated by the prediction information.

27. The system of claim 15, further comprising an automated maintenance service wherein a maintenance operation is performed at times determined by the prediction information scheduled from at least one of a resident computer system and a remote computer system.

28. The system of claim 27, wherein the maintenance service provides at least one of drive organization, drive de-fragmentation, and virus checking.

29. The system of claim 15, further comprising a tracking system to provide prediction information associated with transitory locations of the user.

30. The system of claim 1, wherein the at least one context information source includes at least one of a calendar, a clock, a microphone, a keyboard, a mouse, a camera, a cell phone, a Personal Digital Assistant, and a Global Positioning System.

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31. The system of claim 1, wherein the user state identifier employs at least one of a rules-based determination, a statistical determination, and a decision-theoretic determination.

32. The system of claim 31, wherein the statistical determination utilizes a Bayesian inference to determine the user's state.

33. The system of claim 2, further comprising one or more complementary functions to determine the users at least one of availability and unavailability, the complimentary functions including at least one of a distance to a meeting, a meeting ending time, and data observed in the past.

34. The system of claim 2, the forecaster is constructed from at least one of probabilistic classifiers, support vector machines, Bayesian networks, Bayesian dependency networks, and decision trees.

35. The system of claim 34, the forecaster further comprising forecasts cast as probability distributions, relating to at least one of the amount of time until a user returns to a situation  $i$ , or to a pattern of communication action  $j$ , based on multiple pieces of evidence,  $i$  and  $j$  being integers.

36. The system of claim 34, the forecaster including at least one of how long the user has already been gone, has not had access to a channel and other evidence.

37. The system of claim 36, the other evidence including at least one of a time of day, information on a calendar, location of a current or last appointment, location of a next appointment, a type of day, the type of day including at least one of a weekend, holiday, weekday, and current status of the user.

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38. The system of claim 2, the forecaster employed to function in at least one of an automatic, collaborative, synchronous and asynchronous manner in conjunction with at least one of a contactor, and the contactor and a contactee, to tentatively reschedule a communication or collaboration of one or more forms, based on inferences relating to the users availability.

39. The system of claim 39, the forecaster at least one of utilizing guesses to achieve communications and enabling automatic retries until the communications are successful.

40. A method to coordinate communications systems, comprising:  
determining one or more user states;  
detecting a change of the one or more user states;  
storing user context information at about the time of detecting the change of the one or more user states; and  
building a prediction model from the stored context information.

41. The method of claim 40, further comprising,  
utilizing the prediction model to generate forecasting information regarding at least one of a user's likely return and current availability.

42. The method of claim 41, further comprising,  
sharing the forecasting information with at least one of another user, system, and application.

43. The method of claim 42, wherein the one or more user states include at least one of a presence, an attention, a focus, a goal, and a location associated with the user.

44. The method of claim 41, further comprising,  
generating an automated response based upon the forecasting information.
45. The method of claim 46, further comprising,  
utilizing the automated response in at least one of an e-mail system, voice-mail system, a priorities system, a scheduling system, a maintenance system and a tracking system.
46. A computer-readable medium having computer-executable instructions for performing the method of claim 40.
47. A communications system, comprising:  
means for determining one or more user states;  
means for detecting a change of the one or more user states;  
means for storing user context information at about the time of detecting the change of the one or more user states; and  
means for building a prediction model from the stored context information.
48. The system of claim 47, further comprising,  
means for generating an automated message response based upon forecasting information derived from the prediction model.
49. A signal facilitating communications between messaging systems, comprising:  
a signal to communicate automatically generated responses associated with a user's availability; and  
a predictor constructed from one or more samples of past user actions, the predictor utilized to forecast the user's availability and provide information for the automatically generated response.

50. A system for learning and inferring a user's availability, comprising:  
a presence detector that determines a user's presence and generates presence data indicating whether the user is present and whether there is a probability of the user's presence;  
a data log that stores the presence data generated by the presence detector to accumulate statistics relating to availability and unavailability of the user; and  
a presence predictor constructed from the accumulated presence data to enable a determination of the user's likely return.

51. A communications system, comprising:  
a logging component to store a user's comings and goings over time that relates to one or more states of the user, the one or more states including availability to communicate now *via* one or more forms of channels of at least one of a communication, goal, attention and focus; and  
a prediction component associated with the logging component constructed to predict an amount of time for the user's likely return based upon at least one of recent and current evidence that the user has been away from a location associated with at least one of different types of communication channels and availabilities.

52. The system of claim 51, the prediction component reasons in a non-location-specific manner relating to the time until a user will likely be available for communication with one or more channels or devices.

53. The system of claim 52, the one or more channels or devices including at least one of an e-mail, a telephone, a pager, and a desk-top computer.



54. A communications system providing fine-grained inferences of a user, comprising:

a first component to reason about the amount of time until a user will be available for at least one of a type of interaction and a communications based on patterns of at least one of the user's availability and context; and

a second component to respond to at least one of a system and a user in relation to the reasoning of the first component.

55. The system of claim 54, the first component determining an expected time until a user is available by learning statistics and building models that can infer the availability.

56. The system of claim 54, the first component determining when a user will be available to be interrupted with a particular class of alert or notification, the determination based on at least one of patterns of availability, inferences about a workload and associated cost of an interruption.

57. The system of claim 54, the first component determining where the user is and when the user will be available for at least one of a voice and video conference.

58. An information transfer system, comprising:

a predictive component to estimate when a user will likely be in a setting to review one or more messages; and

an answering component to provide an adaptive message in association with the predictive component relating to when the user is likely to review the one or more messages.

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59. The system of claim 58, the estimate further comprising at least one of when the messages will likely be unseen for some amount of time, the messages are at least of some urgency, and the messages are from one or more people of particular importance to the user.

60. The system of claim 58, the one or more messages populated with dynamically computed availability status, including a forecast of at least one of how long it will be until the user will likely review the messages, be available to review the messages, and be in a particular situation.

61. The system of claim 58, further comprising at least one of a determination of the time until a user reviews different kinds of information based on review histories, and the time until the user will be in one or more types of settings.

62. The system of claim 61, each of the settings associated with one or more types of communications.

63. An automated communications system to send information, comprising:  
a forecaster to determine at least one of when a user will likely see a message, be available to see the message, and be available for one or more types of communications;  
and

a communications component to track at least one of what communications have been sent and to send updates if predictions associated with the forecaster have changed.

64. The system of claim 63, the communications component replying to a collaborating party with at least one of the user is currently away, and it will probably be at least  $x$  hours before the user will see the message,  $x$  being an integer or fraction thereof.



72. An information retrieval system, comprising:  
a forecasting component to determine a user's expected return; and  
a retrieval component to cache information based upon the user's expected return.
73. The system of claim 72, the retrieval component determines an amount of time that a user's device is in contact with a network in order to determine what information is to be cached.
74. The system of claim 72, the retrieval component caches the information based upon at least one of a consideration of network bandwidth and memory capabilities.
75. A method to retrieve information, comprising;  
determining an expected time a user will be away from a system;  
determining information access patterns of the user; and  
performing an approximation to extract a maximum value associated with caching information based on the information access patterns and the expected time away of the user.
76. The method of claim 75, the information access patterns comprising a determination of how long until various items are needed.
77. The method of claim 75, further comprising determining a cost associated with not having an item when needed given that the item is needed at some time  $t$  in the future.
78. The method of claim 77, the cost determination is optimized by considering how long until the user has network availability.

79. The method of claim 77, further comprising determining the size of the items.
80. The method of claim 79, further comprising utilizing a knapsack solution to fit the items into available memory space.

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